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AUTHOR Hilton, Arthur; Lambert, George
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ABSTRACT

Several intermediate performance objectives and corresponding criterion measures are listed for each of 13 terminal objectives for a high school basic machine shop course. The materials were developed for a 36-week course (2 hours daily) designed to enable students to become familiar with the operation of machine shop equipment, to become familiar with those basic skills and trade technology required by the machinist in doing machinist work, and to diagnose and solve technical problems as expected of a competent journeyman machinist. Titles of the 13 performance objectives are the following: Safety (housekeeping, equipment, clothing, handtools); measurement (micrometer, calipers, scale, vernier); layout (centering); lubrication (machines, handtools); benchwork (chipping, filing, scraping); cutting tools; surface grinder; grinder (hand); drill press; power hacksaw; band saw; blueprint reading; and lathe. Also included for some of the intermediate performance objectives are notes on teaching methods and media selection. (This manual and 54 others were developed for various secondary level vocational courses using the System Approach for Education (SAFE) guidelines). (JT)

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BASIC COURSE

DUVAL COUNTY SCHOOL BOARD

CE 010 973

machine shop

PERFORMANCE OBJECTIVES

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July, 1973

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Mr. Arthur Hilton, Coordinator
School Industry Education

Mr. George Lambert, Instructor
Machine Shop Work

Cover design by Mr. Fred Westerfeld, Instructor
Cover printing by Mr. Chester Seivert, Instructor

Typist: Virginia Hale

MACHINE SHOP WORK - BASIC

ACCREDITATION NO. 9553

LENGTH OF COURSE: 36 WEEKS

TIME BLOCK: 2 HOURS DAILY

COURSE DESCRIPTION

This course has been developed to teach the fundamentals of Machine Shop, to become familiar with the operation of Machine Shop Equipment, to become familiar with those basic skills and the trade technology required by the machinist in doing machinist work, to diagnose and solve technical problems as expected of a competent journeyman machinist. First year students will qualify in the following:

A. Orientation
B. Tools
C. Manual Operations
D. Use of Equipment
E. Blueprint Reading
F. Mathematics
G. Heat Treating
H. Hand Forging
I. Related Topics

T.P.O.'S MACHINE SHOP

BASIC

9553

0.0 Orientation

1.0 Safety (housekeeping, equipment, clothing, handtools)

2.0 Measurement (micrometer, calipers, scale, vernier)

3.0 Layout (centering)

4.0 Lubrication (machines, handtools)

5.0 Benchwork (chipping, filing, scraping)

6.0 Cutting tools

7.0 Surface Grinder

8.0 Grinder (hand)

9.0 Drill Press

10.0 Power Hacksaw

11.0 Band Saw

12.0 Blueprint Reading

13.0 Lathe

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 0.0

ORIENTATION

The student will demonstrate his knowledge of career opportunities and related metal trades, industrial education activities, and student hand book by passing a written test with 80% proficiency.

No.	Intermediate Performance Objectives	No.	Criterion Measures
0.1	The student will, with 80% proficiency pass a written test on career opportunities in the machine shop and related metal trades.	0.1	1. What is the average hourly pay scale? 2. Is it necessary to belong to a union? 3. What are the chances for advancement? 4. Name 4 job positions in this field? 5. What are the determining factors for advancement?
0.2	The student will with 80% proficiency pass a written test on the student handbook.	0.1	1. How many credits are received in this course? 2. Does the school have a dress code and would this apply in the shop area? 3. What is the designated area for the class during a fire drill? 4. How many hours are needed before a student can work on the S.I.E. program?

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 1.0 SAFETY

After a series of lectures and demonstrations on safety practices, 80% of the students will answer 70% of the questions on a written test.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		1.0	35 questions test attached.
1.1	Student will demonstrate safe procedures for correctly lifting metal chucks.	1.1	Position for lifting 1) Knees 2) Hands 3) Feet 4) Back
1.2	Given problems in good housekeeping procedures, students will orally solve 90% of the questions.	1.2	Student will explain, and demonstrate when necessary the safe housekeeping procedures in the following situations: 1) Pieces of stock on floor. 2) Grease on floor. 3) Chips on machine. 4) Oily rags on floor and machine.
1.3	Student will demonstrate safety procedures to be followed when using the engine lathe.	1.3	Student will be assigned a lathe and will demonstrate safe procedures to be followed while using several selected components a) Chuck wrench b) 3 jaw chuck c) Tool post b) Belt release lever
1.4	Student will demonstrate safety procedures to be followed when using the milling machine	1.4	Student will be assigned milling machine and will demonstrate safe procedures to be followed while using these component parts. a) Feed change levers b) Speed change levers c) Arbors d) Cutters e) Vise

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 1.0 SAFETY

No.	Intermediate Performance Objectives	No.	Criterion Measures
1.0	Con't.		
1.5	Student will demonstrate safety procedures to be followed when using the shaper.	1.5	Student will be assigned shaper and will demonstrate safe procedures to be followed while using these component parts: a) Rapid traverse b) Speed change lever c) Feed change lever d) clutch
1.6	Student will answer questions on safety with regard to clothing and jewelry.	1.6	Student will answer questions on safety with regard to: a) Shoes b) Gloves c) Tie d) Apron e) Ring f) Watch
1.7	Student will demonstrate safety in the use of hand tools.	1.7	Student will demonstrate safety procedures when using the following hand tools: a) Ball peen hammer b) File c) Chisel d) Crescent wrench e) hacksaw

SAFETY

1. The safe way of lifting a heavy object is to keep your back straight and use the strength of your legs to do the lifting. T or F

2. Which of the following best describes good housekeeping in the machine shop.
   a) A place for everything and everything in it's place.
   b) Cleanliness and neatness.
   c) Disposal cans to receive waste.
   d) All of these.

3. Why is it dangerous to leave pieces of stock on the floor of the shop?

4. Oil and grease that drips on the floor is a safety hazard because a person might slip and fall causing injury. T or F

5. How should chips be removed from the machine?
   a) With compressed air.
   b) With the fingers.
   c) With a brush and pickup.
   d) None of these.

6. What must be done with oily rags?

7. Why should lathe be stopped before making adjustments to the toolholder?

8. Can lifting a lathe chuck onto the spindle cause an accident?

9. What is the best means of supporting the chuck when mounting it onto the lathe spindle?

SAFETY CON'T.

10. How can the machinist avoid possible injury from a flying chuck key?

11. In order to keep up with shop production schedules, the lathe orperator should do his job in the quickest way possible. T. or F.

12. Never test the finish on work with your finger while the work is revolving. T. or F.

13. To save time, always adjust the cutting tool while the lathe is in operation. T. or F.

14. A lathe file should only be used when it
    a) Has been cleaned.
    b) Has been chalked.
    c) Has a handle.
    d) Is a single cut.

15. The greatest hazard in lathe operation is
    a) The sharp tool bit.
    b) Being caught by the revolving chuck or work.
    c) Filing right handed.
    d) Wearing a loose apron.

16. In order to save time on the milling machine check work while the cutter is revolving. T. or F.

17. Never permit another person to start or stop the machine for you. T. or F.

18. What side of the milling machine is the safe side for the operator to stand on when the cutter is revolving?

SAFETY CON'T.

19. Why should the speed and length of the stroke be checked before starting the shaper?

20. Most accidents happen to the_____of the shaper operator.

21. Tools should be kept away from the moving parts of the shaper because:
    a) The tools may be damaged.
    b) Machine will not function properly if it is surrounded by tools.
    c) Operator could be injured and machine damaged by flying tools.

22. Hard toe shoes contribute to personal safety in the machine shop. T. or F.

23. Gloves should be worn at all times to prevent injury to the hands. T. or F.

24. We should stress neatness in the shop at all times. It is recommended that ties be worn by students and teacher during school hours. T. or F.

25. Can long apron tie-strings create safety hazards?

26. Watches and rings should be removed before starting to work because:
    a) They may become damaged if worn on the job.
    b) Wearing a watch tends to make a man a clock watcher.
    c) Watches and rings can become caught on moving parts of the machine causing injury to the operator.
    d) All of these.

27. Filing in the lathe can be hazardous because:
    a) Operator is using a file without a handle.
    b) Operator is filing right handed.
    c) Operator does not hold file firmly.
    d) None of these.
    e) All of these.

SAFETY CON'T.

28. The workman should be very careful when using a hammer that is chipped. T. or F.

29. Never use a hammer that has a loose or split handle. T. or F.

30. Before using a hammer, the workman should make sure:
    a) The wedge is in place.
    b) There is no oil, grease and dirt on the face and handle.
    c) He has the right size hammer for the job.
    d) None of these.
    e) All of these.

31. In using a chisel and hammer, keep the chisel head free from burring by grinding it if necessary. T. or F.

32. Where possible avoid using adjustable wrenches on machinery? Why?
    a) Adustable wrenches are expensive.
    b) Adjustable wrenches are frequently lost.
    c) Because adjustable wrenches are not designed to withstand excessive pressure when in use.
    d) None of these.

33. A hacksaw blade should be mounted with the teeth pointed away from the handle and toward the front of the frame. T. or F.

34. Which of the following rules <u>does not</u> apply to safe hacksawing.
    a) Grip the work in the vise so that the saw cut will be near the jaws.
    b) Only apply pressure on the forward stroke.
    c) Only apply pressure on the draw stroke.

35. What is the most common cause of accidents on the drill press?

ANSWER SHEET ON SAFETY

1. True

2. All of these

3. A workman may step on a piece, slip and fall causing a serious injury.

4. True

5. With a brush and pickup -(c)

6. There should be plenty of disposal cans in designated areas to receive oily rags.

7. When loosening the tool post screw the wrench may swing into the revolving chuck jaws. Also, the operators hand may get caught between the tool post wrench and the revolving chuck jaws.

8. Yes. Lifting a weight at an unusual angle often causes painful back dislocations.

9. A wooden board fashioned correctly to clear the ways at the correct height and formed to the shape of the chuck will make mounting the chuck a safe operation.

10. Never let go the chuck key until it is put in its proper place.

11. False

12. True

SAFETY ANSWER SHEET CON'T.

13. False

14. c) Has a handle

15. b) Being caught by the revolving chuck or work.

16. False

17. True

18. The going away side of the cutter.

19. If the longest stroke is operated at the highest speed, the mechanism of the machine can become damaged.

20. Hands

21. c) Operator could be injured and machine damaged by flying tools.

22. True

23. False

24. False

SAFETY ANSWER SHEET CON'T.

25. Apron tie-strings can be easily caught on the moving parts of any machine.

26. c) Watches and rings can become caught on moving parts of the machine causing injury to the operator.

27. e) All of these.

28. False

29. True

30. All of these (e)

31. True

32. c) Because adjustable wrenches are not designed to withstand excessive pressure when in use.

33. True

34. c) Only apply pressure on the draw stroke.

35. Not having work securely fastened.

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 1.0
Interim Performance Objective 1.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Time Requir
1.1.1	Explain the proper procedure for lifting a 30 pound chuck from the floor to the ways of the lathe.	1.1.1	Demonstrate proper position of knees, hands, feet and back, when lifting 30 lb. chuck from the floor.	1.1.1	Lecture, Textbook, Demonstrations.	
1.2.1	Student will explain safe housekeeping procedures in the following situations: 1) Pieces of stock on floor 2) Grease on floor 3) Chips on machine 4) Oily rags on floor and machine	1.2.1	Demonstrate safe practices to follow when confronted by the conditions now existing in the shop. 1) Pieces of stock on floor 2) Grease on floor 3) Chips on machine 4) Oily rags on floor and machine	1.2.1	Lecture, demonstration	
1.3.1	Student will explain safe procedure to be practiced when using the following components of the lathe 1) Chuck wrench 2) 3 jaw chuck 3) Tool post 4) Belt release lever	1.3.1	Demonstrate safe practices when using the following lathe components 1) Chuck wrench 2) 3 jaw chuck 3) Tool post 4) Belt release lever	1.3.1	Lecture, textbook, demonstration	
1.4.1	Student will enplain safe procedure to be practiced when using the following components of the milling machine. 1) Feed change levers 2) Speed change levers 3) Arbors 4) Cutters 5) Vise	1.4.1	Demonstrate safe practices when using the following milling machine components. 1) Feed change levers 2) Speed change levers 3) Arbors 4) Cutters 5) Vise	1.4.1	Lecture, textbook, demonstrations	

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 1.0
Interim Performance Objective 1.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Ti Req
1.5.1	Student will explain safe procedure to be practiced when using the following components of the shaper. 1) Rapid traverse 2) Speed change lever 3) Feed change lever 4) Clutch	1.5.1	Denonstrate safe practices when using the following shaper components. 1) Rapid traverse 2) Speed change lever 3) Feed change lever 4) Clutch	1.5.1	Lecture, textbook, demonstration	
1.6.1	Student will describe safety rules with regard to clothing and jewelry. 1) Shoes 2) Gloves 3) Tie 4) Apron 5) Ring	1.6.1	State response to the following questions. 1) What type of shoes should be worn in shop? 2) When are gloves worn? 3) Should a tie ever be worn in shop? 4) What is the danger in wearing an apron? 5) Should a ring ever be worn in the shop?	1.6.1	Lecture, Textbook, demonstration	
1.7.1	Student will explain the safe methods of using the following hand tools. 1) Ball peen hammer 2) File 3) Chisel 4) Crescent wrench 5) Hacksaw	1.7.1	Demonstrate the safe ways to hold and use the following hand tools. 1) Ball peen hammer 2) File 3) Chisel 4) Crescent wrench 5) Hacksaw	1.7.1	Lecture, textbook, demonstration	

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 2.0

MEASUREMENT

After a series of lectures and demonstrations with measuring devices 80% of the students will demonstrate their ability to measure accurately to 90% efficiency.

No.	Intermediate Performance Objectives	No.	Criterion Measures
2.1	Student will demonstrate their proficiency in the care and use of various measuring tools.	2.1	Given a micrometer, the student will explain. 1) Care and use 2) How to hold 3) Readings on pieces of metal provided by instructor. 4) Name parts Given an inside and outside caliper student will name their parts, care and use, and how to take readings. Student will identify graduations on the six inch scale.

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 2.0
Interim Performance Objective 2.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requi
2.1.1	Identify the parts of a micrometer	2.1.1	List the parts of the micrometer.	2.1.1	Textbook, MFG. Bulletins	
2.1.2	Explain the care and use of the micrometer.	2.1.2	Demonstrate care and use of the micrometer.	2.1.2	Textbook, MFG. Bulletins, lectures, Demonstrations	
2.1.3	Identify parts of the inside and ourside calipers.	2.1.3	Write parts of the inside and outside calipers.	2.1.3	Textbook, MFG. Bulletins	
2.1.4	Explain the care and use of inside and outside calipers.	2.1.4	Demonstrate care and use of inside and outside calipers.	2.1.4	Lecture, textbooks	
2.1.5	Identify graduation of the 6" scale.	2.1.5	List the graduations to be found on the 6" scale.	2.1.5	Text	

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 3.0

LAYOUT WORK

Upon completion of a series of lecture and demonstration on layout work 80% of the students will be able to answer 70% of the questions on a written test.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		3.0	Test attached.
3.1	Given a scribe, the student will scribe a ½ inch line around a square block.	3.1	Use and explain the following tools. 1) Surface gage 2) Surface plate 3) Layout blue
3.2	Given a protractor and chalk, the student will locate the center on each end of the material.	3.2	Student will perform the following operations: 1) Chalk each end of work piece. 2) Scribe 3 or 4 intersecting lines on each end of piece. 3) Center punch where lines interest.

QUESTIONS ON LAYING OUT

1. What is chalk used for in layout work? When is whiting used?
2. What solution is used on surfaces which have been machined, to make the lines show more distinctly? How is it made?
3. What is the difference between a prick punch and a center punch?
4. What do you mean by a light indentation with a prick punch? For what purpose is a light indentation used?
5. Why is a divider set by feel more accurate than when set by sight?
6. What tool is used for a heavy indentation? Why? When is a heavy indentation made? Give reasons.
7. Why is a series of prick punch marks sometimes made to show the location of the circle? When are they used in other line work?
8. On finished work is this necessary? Is it advisable? Give reasons.
9. How are lines parallel to each other or parallel to a base usually scribed?
10. How are lines at an angle to a given line or base usually scribed?
11. How are intersections accurately laid off from a finished surface? From an established point?
12. What do you mean by checking the layout? When is it advisable?
13. Explain the use of the following tools used in layout work: scale, scriber, hermaphrodite caliper, divider, surface gage, prick punch, center punch?
14. Explain the use of the following tools used in layout work: bench plate, angle plate, parallels, parallel clamps, C clamps, square, bevel protractor, height gage.
15. What is the distance across the flats of the largest square that can be filed on the end of a cylinder 1 inch in diameter? 2 inches in diameter?
16. To what dimension should a divider be set to space equally ten holes in a 5 inch circle? Five holes in a 10 inch circle?

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 3.0
Interim Performance Objective 3.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requ
3.1.1	Identify tools needed to scribe a ½ inch line around a square block.	3.1.1	List tools needed to scribe ½ inch line around a square block.	3.1.1	Lectures, Textbook	.3
3.2.1	List the tools needed to locate the centers on each end of the material provided.	3.2.1	List the tools needed to locate the centers on each end of the material provided.	3.2.1	Lectures, Textbook	.3

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 4.0 LUBRICATION

Upon completion of the lectures and demonstrations on lubrication 80% of the students will answer 70% of the questions on a written test.

No.	Intermediate Performance Objectives	No.	Criterion Measures
4.0		4.0	Test attached.
4.1	Student will demonstrate proper lubrication of the lathe shaper and milling machine.	4.1	Given oil can and grease gun, student will service the lathe, shaper and milling machine.

LUBRICATION

1. What is SAE?
2. What does viscosity mean?
3. Why do the oil companies grade oil and grease?
4. Why is refinement important in lubricants?
5. Why is cleanliness important in a lubrication system?
6. What is a filter?
7. Name at least 3 kinds of filters.
8. How often does oil wear out?
9. What is the difference between an oiler and a luber?
10. How do you keep the end of a oil can from getting stop up?
11. What are the 3 types of oil recepticals in machines?
12. What is meant by a sealed bearing?
13. What is meant by oilless lubrication?
14. What is a high temp lubrication?
15. What value is reclaimed lube oil?
16. What is meant by non-foaming lubrication?
17. How does temperature affect lubrication?
18. What is the best cleaner for a machine before lubrication?
19. How do you know what oil or grease to use on a machine?
20. Can you ever oil or grease a machine? What damage can be done?

Terminal Performance Objective 4.0
Interim Performance Objective 4.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Ti Requ
4.1.1	Explain the procedures to be followed when oiling and greasing the lathe.	4.1.1	State response to the following questions. 1) Which parts of the lathe are oiled daily, weekly? 2) What weight oil is used? 3) What type of grease is used?	4.1.1	Lectures, Text, Manufacturers, Bulletins, Overhead Projector.	
4.1.2	Explain the procedures to be followed when oiling and greasing the milling machine.	4.1.2	State response to the following questions. 1) Which parts of the milling machine are oiled daily, weekly, monthly? 2) What type of grease is used? 3) What type of oil is used?	4.1.2	Lectures, Text, Manufacturers, Bulletins, Overhead projectors.	
4.1.3	Explain procedures to be followed when oiling and greasing the shaper.	4.1.3	State response to the following questions. 1) Which parts of the shaper are oiled daily, weekly, monthly? 2) What type of grease is used? 3) What weight of oil is used?	4.1.3	Lectures, Text, Manufacturers, Bulletins, Overhead projectors.	

ACCREDITATION NUMBER 9553

COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 5.0 BENCH WORK

After a series of lectures and demonstrations on bench work, 80% of the students will be able to answer 70% of the questions on a written test, and perform with 70% efficiency on given performance tests.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		5.0	25 questions attached.
5.1	Given a hammer and chisel student will demonstrate 70% proficiency in chipping operation.	5.1	Students, given a cape chisel will 1) Chip keyway until key fits properly and flange will slide on shaft.
5.2	Given a file student will demonstrate 70% proficiency in the filing operation.	5.2	Student will file .002 from diameter of piece provided, demonstrating use of course, 2nd out and smooth files.
5.3	Student will demonstrate 70% proficiency in the scraping operation using 3 types of scrapers.	5.3	Given a bent scraper, the student will smooth inner surface of bearing provided.

BENCH WORK

CHIPPING

1. How far back is a cold chisel hardened?
2. After a chisel has been sharpened several times, is it still as hard as ever on the cutting edge? Give reason.
3. Why is a wet grinder better for grinding tools than a dry grinder?
4. What is the best cutting angle for a cold chisel? Why not 90 degree? Why not 50 degrees?
5. If no grinder is available, how may a cold chisel be sharpened?
6. What is a flat chisel? What is a cape chisel? What is a gouge chisel?
7. Where and how should the hammer handle be grasped? Why?
8. How should a chisel be grasped? How tightly?
9. What kind of a chisel is used for chipping a keyway?
10. Is it proper to lubricate a cold chisel when chipping steel?

FILING

1. What is one reason for having the file slightly convex or bellied?
2. Should the file be lifted from the work on the return stroke? What is the reason?
3. What are the difference between a flat file and a hand file?
4. What is the difference between a bastard? Second cut? Smooth?
5. In what way does the mill file differ from the other files?
6. How is the length of a file measured?
7. When should the coarser files be used? When should the finer files be used?
8. What is a file card? How may a piece of brass or copper rod be made into a most efficient file cleaner?

FILING - BENCH WORK CON'T.

9. What causes pinning? How may the pin be removed?

10. Is a half round file half round?

SCRAPING

1. Is there a difference between the cutting angle of a flat scraper and a scraper for curved work?

2. Is the end of a flat scraper straight? What shape is it lengthwise? Crosswise?

3. Of what kind of steel is a scraper made? Why?

4. How is a scraper hardened? How is it tempered?

5. What care must be taken when grinding a scraper?

6. What are the advantages of a scraped surface?

7. How do you determine when a surface is sufficiently scraped?

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 5.0
Interim Performance Objective 5.2

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Requ
5.2.1	Show the 3 files needed to remove .002 from diameter of piece provided.	5.2.1	List names of the 3 files to be used to remove .002 from 1" piece of stock provided. Why?	5.2.1	Lecture, Textbook	
5.2.2	Explain how to hold file. How to perform the proper stroke.	5.2.2	Demonstrate the proper way to hold the file. How to perform the proper stroke.	5.2.2	Lecture	
5.2.3	Explain the cleaning and care of the files.	5.2.3	Demonstrate the use of file card and chalk.	5.2.3	Lecture, Textbook	
5.3.1	Identify the 3 different types of scrapers and their use.	5.3.1	List the names of the 3 different types of scrapers and their use.	5.3.1	Lecture, Textbook, Demonstration.	

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 5.0
Interim Performance Objective 5.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Requ
5.1.1	Identify tools needed in chipping operation.	5.1.1	List tools needed for chipping operation on piece of paper.	5.1.1	Lecture, Textbook	
5.1.2	Show proper way to hold tools at start of operation.	5.1.2	Demonstrate proper way to hold tools at start of operation.	5.1.2	Demonstration	
5.1.3	Explain the proper depth in shaft for a $\frac{1}{4}$" key.	5.1.3	Give proper depth in shaft for $\frac{1}{4}$" key.	5.1.3	Lecture, Textbook	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 6.0 CUTTING TOOLS

Upon completion of the lecture and demonstrations on the care of cutting tools 80% of the students will be able to demonstrate 70% accuracy in the proper grinding of cutting tools.

No.	Intermediate Performance Objectives	No.	Criterion Measures
6.0			
6.1	Given a tool bit student will demonstrate 90% proficiency in the grinding operation.	6.1	Student will grind $\frac{1}{4}$" tool bit on pedestal grinder paying particular attention to the following. 1) Side rake angle. 2) Back rake angle. 3) Side clearance angle. 4) End clearance angle. 5) End cutting edge angle. 6) Side cutting edge angle.

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 6.0
Interim Performance Objective 6.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requ
6.1.1	Identify the 3 types of cutting tools used in lathe work.	6.1.1	List the 3 types of cutting tools used in lathe work	6.1.1	Textbook, Lectures	
6.1.2	Identify the following: A) Side rake B) Back rake C) Side clearance D) End clearance E) Side cutting edge angle. F) End cutting edge angle.	6.1.2	Define orally the following: A) Side rake B) Back rake C) Side clearance D) End clearance E) Side cutting edge angle. F) End cutting edge angle.	6.1.2	Textbook, Lectures	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 7.0

SURFACE GRINDER

After a series of lectures and demonstrations on the surface grinder, 80% of the students will identify 70% of the parts and their function.

No.	Intermediate Performance Objectives	No.	Criterion Measures
7.1	Given a surface grinder student will demonstrate 90% efficiency in the operation of the surface grinder.	7.1	Student will demonstrate operation of: 1) Parts of the surface grinder. 2) Grinding wheels. 3) Set up devices. 4) Coolants and dry cutting. 5) Spindle speeds. 6) Wheel dressing. 7) Cutting

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 7.0
Interim Performance Objective 7.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requi
7.1.1	Identify the parts of a surface grinder.	7.1.1	List parts of the surface grinder.	7.1.1	Textbook, mfr. bulletin, overhead projector and visual sides.	
7.1.2	Identify the grinding wheel care and use.	7.1.2	Select proper grinding wheel.	7.1.2	Charts, Textbook	
7.1.3	Demonstrate set up on surface grinder.	7.1.3	Attach work to table with holding devices.	7.1.3	Holding devices magnetic chuck.	
7.1.4	Explain wet or dry cutting.	7.1.4	Compare surface grind of wet and dry grinding.	7.1.4	Grinder-coolants.	
7.1.5	Demonstrate Tachometer for spindle speeds.	7.1.5	Set spindle speed for selected grind stone.	7.1.5	Tachometer	
7.1.6	List steps in dressing wheel.	7.1.6	Select diamond dresser-dress wheel.	7.1.6	Wheel dresser (Hand) Diamond dresser (Machine)	
7.1.7	Demonstrate surface cutting.	7.1.7	Remove and mike .050 fifty thousandths from stock-check for taper cut.	7.1.7	Micrometer	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 8.0 BENCH AND PEDESTAL GRINDER

Given a bench or pedestal grinder and metal for a grinding job the learner will correctly and safely use the equipment to produce a finished product within 90% tolerance as assigned.

No.	Intermediate Performance Objectives	No.	Criterion Measures
8.1	Given a bench grinder student will demonstrate 90% efficiency in the operation of the bench grinder.	8.1	Student will demonstrate functions of: A) Wheels B) Wheel dresser C) Wheel guards D) Drill grinding attachment E) Tool rest

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 8.0
Interim Performance Objective 8.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Requ
8.1.1	Identify the parts of a bench grinder	8.1.1	List the parts of the bench grinder.	8.1.1	Lecture, Textbook, Demonstrations.	
8.1.2	Identify the different types of grinding wheels.	8.1.2	Lecture, Textbook, Demonstrations	8.1.2	Lecture, Textbook, Demonstrations.	
8.1.3	Explain wet and dry grinding	8.1.3	List advantages of wet grinding over dry grinding.	8.1.3	Lecture, Textbook, Demonstrations.	
8.1.4	Explain use of tool rest.	8.1.4	List uses of the tool rest.	8.1.4	Lecture, Textbook, Demonstrations.	

QUESTIONS ON DRILLING MACHINE

1. What is a drill chuck? What kind of a shank has it? Why is the shank provided with a tang?
2. If the taper shank of the drill is too small for the hole in the spindle of the machine, how is the drill held?
3. What is a drift key used for? How is it used? What is the objection to using a drift upside down?
4. Give reason for wiping shank of drill or chuck clean and dry before being thrust into spindle.
5. Is the hold of the taper alone sufficient to keep the drill from turning in the socket? What two things hold the drill from turning?
6. What faults in the setting of the drill might result in the tang being twisted off.
7. Why are the smaller sizes of drills made with straight shanks?
8. Define drilling, reaming, boring, and spot-facing.
9. What is the difference between counterboring and countersinking?
10. If the taper shank of the chuck is too small for the spindle hole, what do you use? How is the chuck made secure in the spindle?
11. When would you use a magic chuck? Why?
12. When would you use a floating holder? Why?

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 9.0 DRILL PRESS

Upon completion of a series of lectures and demonstration on the drill press 80% of the students will answer 70% of the questions on a written test, and perform with 70% efficiency on given performance tests.

No.	Intermediate Performance Objectives	No.	Criterion Measures
9.1		9.1	Test attached.
9.2	Given a drill press and metal, student will operate the machine with 90% proficiency.	9.2	Student will operate drill press using proper procedures as follows: 1) Accurately locate and center punch. 2) Select correct size drill. 3) Check for sharpness and shape. 4) Secure work. 5) Drill four 3/8" holes, 1" apart.

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 9.0
Interim Performance Objective 9.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Requ
9.1.1	Identify parts of a drill press.	9.1.1	List the parts of a drill press.	9.1.1	Lecture, Textbook	
9.1.2	Identify the parts of a Jacobs Chuck.	9.1.2	List the parts of a Jacobs Chuck.	9.1.2	Lectures, Textbook	
9.1.3	Identify 3 holding devices used on the drill press.	9.1.3	List 3 holding devices used on the drill press.	9.1.3	Lectures, Textbook, Demonstration	
9.1.4	Identify 3 types of drills used in a drill press.	9.1.4	List 3 types of drills used in a drill press.	9.1.4	Lectures, Textbook, Demonstration.	
9.1.5	Identify the safety precautions to be followed when doing any drilling job.	9.1.5	List safety precautions to be followed when doing any drilling job.	9.1.5	Lecture, Textbook, Demonstration.	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 10.0 POWER HACKSAW

After a series of lectures and demonstrations on the power hacksaw 80% of the students will be able to answer 70% of the questions on a written test, and perform with 70% efficiency on given performance tests.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		10.0	Test attached
10.1	Given a 10" blade for power hacksaw, student will demonstrate 100% proficiency installing blade in hack saw.	10.1	Student will install 10" blade in power hacksaw paying attention to safety procedures involved.
10.2	Given a piece of stock 3" long student will demonstrate 100% proficiency setting up a short piece of stock in hacksaw.	10.2	Student will install piece of steel 3" diameter 3" long in power hacksaw. Piece must be tightened securely and safety precautions observed before starting machine.

POWER HACKSAW

1. Name several principal parts of a power hacksaw.
2. Can hardened steel be cut in a power saw? Why?
3. What is meant by the feed of a saw?
4. Which direction should the teeth of a power hacksaw point?
5. Explain the function of a cutoff gage on a power saw.
6. What advantages are achieved in using a cutting fluid on a power saw?
7. On which stroke does a power hacksaw blade cut?
8. How can the feed pressure be increased or decreased on power hacksaw?
9. List the recommended cutting speed for cutting low-carbon steel without cutting fluid.
10. List several factors which must be considered when selecting the proper power hacksaw blade for a job.
11. List the types of tooth set on power hacksaw blades?

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 10.0
Interim Performance Objective 10.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requi
10.1.1	Identify tools needed to install 10" blade in power hack-saw.	10.1.1	List tools needed to install 10" blade in the power hack-saw.	10.1.1	Lecture, Textbook, Demonstration.	
10.1.2	List precautions necessary when installing short piece of stock (3" diameter, 3" long) in power hacksaw.	10.1.2	Demonstrate procedure for installing short piece of stock (3" diameter 3" long) in power hacksaw.	10.1.2	Lecture, Textbook, Demonstrations.	

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COURSE TITLE: MACHINE SHOP WORK -BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 11.0

BAND SAW

Upon completion of a series of lectures and demonstrations, the student will identify the parts and function of the band saw. 70% proficiency is required in addition 80% of the students will answer 70% of the questions on the written test, and perform with 70% efficiency on given performance tests.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		11.0	Test attached.
11.1	Student will secure piece to be cut and draw layout lines on it.	11.1	Given piece of metal, the student will secure it and draw layout lines on it.
11.2	Student will select proper blade for job and set the desired speed.	11.2	Student will install proper blade in machine, set the speed and feed and proceed with caution.

BAND SAW

1. Name at least three features of a metal-cutting band saw?
2. Name four functions of a band tool that make it different from any other cutting tool?
3. Define the following: kerf, pitch, left lead, right twist, band velocity, and cutting rate.
4. Name the three different types of patterns found on band saws.
5. Name five types of saw blades and describe them briefly.
6. Name at least one use for each of the various saw blades mentioned in the text.
7. Describe friction sawing.
8. Tell how you would mount a new saw blade in a metal cutting band saw.
9. How should the teeth on the saw blade point when being mounted on a machine? Why?
10. Describe the value of the job-selector chart on the DoAll machine.
11. What is the purpose of the blade guides?
12. What is the formula for finding the length of the saw band?
13. What is the purpose of the DoAll butt welder?
14. Why must a welded saw band be annealed?
15. After the welded saw band has been ground, it is tested for thickness. Why?
16. How is the speed of the band saw measured?
17. What is the range of speed possible on the DoAll Contour-matic?

BAND SAW TEST CON'T.

18. There are three ranges of speeds on the above machine. What are they?

19. Why are proper cutting speeds important when using a metal-cutting band saw?

20. Name five materials that can be cut on a band saw.

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 11.0
Interim Performance Objective 11.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requ
11.1.1	Identify tools needed to lay out piece before cutting.	11.1.1	List tools needed to layout piece before cutting.	11.1.1	Lecture, Textbook, Demonstrations.	
11.1.2	a) Identify the different type blades used in cutting operations. b) Explain the speed used for steel, brass and aluminum. c) Explain the automatic feed.	11.1.2	a) List the different type blades used in cutting operations. b) List the speed used for steel, brass, aluminum. c) List the automatic feeds used for cutting brass, aluminum, steel.	11.1.2	Lecture, Textbook, Demonstrations.	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 12.0 BLUEPRINT READING

Upon completion of the lectures on blueprints and blueprint reading 80% of the students will be able to demonstrate their ability to understand, interpret symbols and abbreviations and draw to $\frac{1}{2}$" scale, 3 different type prints with 90% accuracy.

No.	Intermediate Performance Objectives	No.	Criterion Measures
12.0		12.0	Test attached.
12.1	Student will demonstrate 70% accuracy interpreting a working drawing.	12.1	Given a working drawing student will demonstrate 70% proficiency in reading the following: 1) Shape of every part of the object. 2) Size of all parts. 3) Kind of material. 4) Kind of finish. 5) How many pieces of each part are wanted.
12.2	Student will draw 3 different type of prints demonstrating 70% proficiency.	12.2	Given pencils and paper, student will sketch 3 different types of sepia print

BLUEPRINT READING

1. What is a working drawing?
2. Who uses working drawings?
3. What is a mechanical drawing?
4. What is a tracing?
5. What is a blueprint?
6. Draw samples of the different lines used on working drawings and name them?
7. What do the following abbreviations mean: Dia, RH, LH, R, USS, SAE, THDS, NC, NF?
8. What view appears directly below the top view?
9. What is an overall dimension?
10. What is the scale of a quarter-size drawing?
11. What is a cross section?
12. What does design mean?
13. What is a sketch?
14. Who makes sketches?

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 12.0
Interim Performance Objective 12.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	T Requ
12.1.1	Given a working drawing student will explain the different symbols and abbreviation contained there in.	12.1.1	Student will list 12 abbreviations and symbols found on a working drawing.	12.1.1	Lecture, Textbook	
12.2.1	Student will identify the tools needed to sketch a sepia print.	12.2.1	Student will list the tools necessary to sketch a sepia print.	12.2.1	Lecture, Textbook	
12.2.2	Student will distinguish the difference between lines, arc and circles.	12.2.2	Student will identify the difference between lines arcs, and circles with 70% proficiency.	12.2.2	Lecture, Textbook	

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 13.0 MACHINE LATHE

Upon completion of the series of lectures and demonstrations on the lathe, encompassing the parts, their functions, accessories and manipulation, 80% of the students will be able to demonstrate 70% accuracy on both the written and oral tests, and perform with 70% efficiency on on given performance tests.

No.	Intermediate Performance Objectives	No.	Criterion Measures
		13.0	Written test included.
13.1	Given a machine lathe, a student will orally identify 90% of the parts on the machine.	13.1	Student will recall 90% of the parts by oral identification.
13.2	Student will orally explain the function of the control.	13.2	Student will orally explain 90% of the control and their function.
13.3	Student will grind 60° tool for cutting and a facing tool.	13.3	Student will grind a 60° angle cutting tool and L.H. facing tool measuring within 2° on the center gauge.
13.4	Student will center round shaft between centers.	13.4	Student will select 8" of round stock layout center hole with center square and center drill between centers.
13.5	Student will face shaft between centers	13.5	Student will face shaft using both dead center and facing center.
13.6	Student will demonstrate 70% proficiency in straight cutting.	13.6	Student will cut 1" cold shaft to 7/8" with no more than .003 taper per foot.
13.7	Student will demonstrate 70% proficiency in shoulder turning.	13.7	Student will cut the following shoulder cuts. 1) Square 2) Radius 3) Rounded edge 4) Chamfered edge
13.8	Student will demonstrate 70% proficiency with follow rest and center rest.	13.8	1) Student will demonstrate the centering with the center rest-cutting on both sides of center. 2) Student will demonstrate cutting with follow rest cutting within. .003 on a $\frac{1}{4}$" x 12 shaft.

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COURSE TITLE: MACHINE SHOP WORK - BASIC

TERMINAL OBJECTIVE
OBJECTIVE NO. 13.0 MACHINE LATHE

No.	Intermediate Performance Objectives	No.	Criterion Measures
13.9	Student will demonstrate use of the 4 jaw angle, 3 jaw chucks.	13.9	a) Student will demonstrate use 4 jaw chuck centering the following: 1) Round stock 2) Hexagon stock 3) Rectangular stock b) Centering in 3 jaw chuck 1) Round stock 2) Hexagon stock 3) Rectangular stock
13.10	Student will demonstrate use of collet	13.10	Student will demonstrate the following: a) Collet size and selection b) Install draw and install stock c) Install draw and tighten d) Check for entering.
13.11	Student will demonstrate use of cut off tool.	13.11	Student will demonstrate the cutting off operation.
13.12	Student will demonstrate the use of a drill and reamer.	13.12	Student will drill a 31/64 hole thin ream to .005 then measure for 90% accuracy.
13.13	Student will demonstrate the use of a boring tool or boring bor.	13.13	Student will drill .500 pilot hole in stock then bore hole to .800 with boring tool to 90% accuracy.
13.14	Student will demonstrate the use of a taper.	13.14	Student will cut a No. 3 morse taper on a dead center to the nearest .001 inch.
13.15	Student will demonstrate the V form thread.	13.15	Student will cut a .375 stock to .371 then cut 3/8-16 NC thread on stock for 2".

1. What are the ways used for?
2. How are they shaped?
3. How are they finished? Why?
4. How is the carriage moved by hand?
5. Where is the feed rock located?
6. How are the ways cleaned and oiled?
7. What will happen if the ways become dry?
8. Where is the live center located?
9. Where is the dead center located?
10. Why are centers called dead and live?
11. Which center is hard and which is soft? Why?
12. How is the tailstock adjusted sideways?
13. Why is it necessary to first loosen the clamping bolts?
14. How is the tailstock spindle tightened?
15. What establishes the center line of the lathe?
16. What is the center line parallel to?
17. When is the dead center live?
18. How is the live center removed?

19. What part of the carriage is called the saddle?

20. What part of the carriage is called the apron?

21. Why does a machinist, before starting to work on a lathe, always try the carriage to make sure that it runs freely?

22. How do you determine the size of the lathe?

23. What is the main difference between a bench and engine lathe?

24. When should a lathe be lubricated?

25. Adjustment should be made on a machine when?

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 13.0
Interim Performance Objective 13.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Ti Requ
13.1.1	Students will describe 90% of the posts on the lathe.	13.1.1	Students will list parts and describe their function.	13.1.1	Machine lathe, overhead projector visual aids.	
13.2.1	Students will identify the parts in the machine to describe functions of controls.	13.2.1	Students will orally explain the functions of lathe control.	13.2.1	Machine lathe	
13.3.1	Student will grind a practice tool for the L.H. 60° cutting tool.	13.3.1	Student will grind a 60° L.H. cutting tool with 12° front relief 4° top relief.	13.3.1	3/8 x 3/8 cold roll stock 3" long center gauge pedestal grinder layout blue scribe.	
13.4.1	Student will demonstrate layout and center drill stock to face between centers.	13.4.1	Student will drill with a No 5 centers 1 " x 12 " CRS	13.4.1	Machine lathe 12 " x 1 cold roll steel No 5 center drill No 3 Jacobs Chuck layout blue scribe center head hammer center & Prick Puncher.	
13.5.1	Student will face both ends of stock.	13.5.1	Student will face ends of 1" x 12" CRS using a L.H. facing tool and facing center	13.5.1	1" x 12 CRS L.H. facing tool facing center.	
13.6.1	Student will demonstrate straight cut without taper.	13.6.1	Student will remove 1/8 metal from 12 x 1" CRS round stock checking for taper each 4" allowing no more than .001 per 4".	13.6.1	12 x 1" CRS round 60° cutting tool o"-1" micrometer 6" scale.	
13.7.1	Student will demonstrate roughing in and finish shoulder cutting.	13.7.1	Student will cut 12 x 1" cold roll round .250 x 3" steps using square shoulder 1/8 radius and 1/8 radius round edge 1/8 champered edge.	13.7.1	60°L.H. cutting tool L.H. facing tool 1/8 radius tool 1/8 round concave forming tool.	
13.8.1	Student will demonstrate the centering of center rest with indicator.	13.8.1	a) Student will center and reduce 1x 12" CRS shaft to 7/8" b) Student will cut $\frac{1}{4}$ x 12" shaft to 3/16 using follow rest.	13.8.1	60 cutting tool 12 " x 1" CRS 12" x $\frac{1}{4}$" CRS.	

FUNCTIONAL PERFORMANCE ANALYSIS

Terminal Performance Objective 13.0
Interim Performance Objective 13.1

No.	Learning Steps	No.	Criterion Performance Evaluation (Response)	No.	Method/Media Selection	Ti Requ
13.9.1	Student will demonstrate the installation use and removal of the 4 jaw chuck and 3 jaw chuck.	13.9.1	Student will center round stock check for 90% accuracy by indicator.	13.9.1	Demonstration 12 x 1 " CRS .001 indicator.	
13.10.1	Student will demonstrate the installation use and removal of a collet.	13.10.1	Student will install 3/4 collet using 12 x 3/4 " CRS facing and center drilling each end.	13.10.1	Demonstration 3/4 collet 12 x 3/4 CRS center drill chuck L.H. facing tool.	
13.11.1	Student will demonstrate the process of cutting off in a collet.	13.11.1	Student will install 12 x 3/4" CRS in a machine drill a $\frac{1}{4}$ hole then cut off,.062 width to form a washer $\frac{1}{4}$ x 3/4 x .062 and holder.	13.11.1	Demonstration 3/4 collet 12 x 3/4 CRS $\frac{1}{4}$ drill chuck 1/8 or 3/32 cut off tool.	
13.12.1	Student will demonstrate how to set up and use the boring bar or boring tool.	13.12.1	Student will demonstrate by drilling a 31/64" hole then set adjustable ream with a micometer to .500" ream the hole then measure with small hole gauge and micrometer.	13.12.1	Demonstrate 1" x 1" CRS round 31/64 drill bits chuck adjustable reamer 0"-1" micrometer small hole gauge.	
13.13.1	Student will demonstrate how to set up and use the boring bar or boring tool.	13.13.1	Student will demonstrate the use of boring bar by cutting a .005 " hole to .800"	13.13.1	Demonstrate boring bar holder $\frac{1}{2}$" drill bit.	
13.14.1	Student will demonstrate the setting of a taper attachment	13.14.1	Student will demonstrate his ability to cut a No 3 morse taper and 60° tapered end to form a center.	13.14.1	L. H. cutting tool 6" x 1" CRS round.	
13.15.1	Student will demonstrate the set up of lathe to cut a V-form thread.	13.15.1	Student will demonstrate his ability to cut a 3/8" x 16 NC thread 2" in length to fit and a 3/8" x 16 NC nut.	13.15.1	60°cutting tool 3" x 3/4 CRS round center gauge 3/8 x 16 NC nut.	